

## CHALLENGES IN THE NEW MILLENNIUM: EARTH ROTATION STUDIES FROM AN EARTH SYSTEM SCIENCE PERSPECTIVE

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The study of Earth rotation encompasses the complex nature of orientation changes, the excitation of these changes and their geophysical implications in a broad variety of areas. These changes occur over a broad spectrum of time scales, ranging from minutes to millions of years, reflecting the fact that they are produced by a wide variety of geophysical and astronomical processes. In last quarter of a century, Earth system studies have made major advances with the advent of accurate space geodetic techniques with high temporal resolution and the increasing availability of complementary geophysical data. Highly accurate observations of Earth rotation provide a unique and truly global measure of natural and man-made changes in the atmosphere, oceans, and interior of the Earth and enable insights into geophysical processes, which are often difficult to obtain by other means. Examples include the measurement of the change in the Earth's oblateness (the  $J_2$  dot effect); the detection of nontidal oceanic effects in both length-of-day and polar motion; and unprecedented measurements of the Earth's nutation and associated insights into the Earth's interior. The new millennium promises to be even more exciting with the recent launches (e.g. Terra and Quicksat) and planned missions (e.g. GRACE, GOCE and ICESAT) along with anticipated advances in models and data assimilation. Current activities will be reviewed; anticipated advances and prospects for the new millennium will be featured.